EXHIBIT A

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF GEORIA
ATLANTA DIVISION

NOVUM STRUCTURES, LLC, Plaintiff, v. CHOATE CONSTRUCTION COMPANY, Defendant.	))))))))))	CIVIL ACTION FILE NO. 1:15-cv-00335-LMM

DEFENDANT'S EXPERT REPORT

June 9, 2020

Robert Spindler

Expert Qualifications – Robert Spindler

Education – (B.E.) Bachelor of Engineering - Youngstown State Univ. - Graduate Studies University of Pittsburgh

Glass industry Expertise

- Forensic analysis of glass breakage - annealed, heat treated (heat strengthened, tempered (thermal and ion exchange). Thermal Stress, Bending Stress, and Impact.

- Forensic analysis of Insulating Glass failures caused by incompatibility of sealant materials, coating failures, pressure induced stresses, thermal stresses, poor glazing, internal fogging, etc.

- Forensic analysis of laminated glass failures (PVB and SGP Interlayers)

- Design and testing of Glass products for specific applications i.e. Aircraft Windshields, Blast Resistance, Hurricane Impact, Acoustics, Windload and

Snowload Analyses, Commercial Curtainwall applications, Residential Window Applications, Structural Glazing, High Altitude, etc.

- Review of Commercial and Residential Glazing Details to reduce the opportunity of premature glass failures.

- Tempering problems and resolutions i.e. distortion (outdoor and indoor), bow.

- Nickel Sulfide (NiS) Breakage (Inclusions) – Breakage evaluation, and science of inclusions.

- Heat Soaking to reduce the potential of breakage from NIS stone inclusions.

- Glass Product Applications to reduce heat gain in summer and heat loss in winter. Glass Thermal and Optical Performance.

Education

- BE – Bachelor of Engineering – Youngstown State University, Graduate Studies – University of Pittsburgh

- Seminars of higher education i.e. Glass Windload design at Texas Tech University, etc.

Work Experience

- Goodyear Aerospace Akron Ohio - 1966 - 1968 – Design Engineer

    - Aircraft Windshield Design – Insulation Systems for Saturn S IVB Rocket Motor Casing

- PPG Industries – Pittsburgh Pa. – 1968 - 1983 - Sr. Research Engineer, Product Development Manager, Technical Service Manager

    - Commercial and Military Aircraft Windshield Design, Commercial and Residential Glass Applications, Forensic Analyses of Commercial and Residential glass failures, Reflective and LoE Coating

Development and Analysis, Glazing Review, Energy Analysis of Glass Products for Residential and Commercial Applications, etc.

- Cardinal Glass Industries – Minneapolis MN. 1983 – 2013 Director Sales and Marketing Commercial, VP Technical Services

    - Commercial and Residential Glass Product Design, Forensic Analysis of Field Glass Failures and Problems, Technical Articles and Brochures, Technical Service Bulletins, Training and Seminars on Glass Technology, Application analysis of Glass Products for Commercial Curtainwall and Residential Windows. Etc. Etc.

Patents

- 6 Patents on Aircraft Windshield Design, and Glass products for Residential Applications.

Industry Involvement

- Past President and Board Member of IGCC (Insulating Glass Certification Council)

- Past President and Board Member of GICC (Glazing Industry Code Committee)

- Chairman of IGMA (Insulating Glass Manufacturing Alliance) Technical Service Committee and Board Member

- Past Chairman of ASTM (American Society of Testing Materials) E06.35 Structural Glazing

- Past Involvement in SGCC (Safety Glazing Certification Council), NFRC (National Fenestration Rating Council), GANA (Glass Association of North America, ASTM Committees E06 (Performance of Buildings) and ASTM C24 (Building Seals and Sealants) and ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers).

Published Articles – Cardinal Glass Industries

- **Technical Service Bulletins 1993 – 2014**

IG01 | (05/08) Information on Glass Products

- IG02 | (09/13) Argon Gas in the Air Space of IG Units
- IG03 | (10/14) Glass Windload Tables
- IG04 | (10/14) Use of Retrofit Films
- IG05 | (05/14) Performance Data and Comparisons
- IG06 | (05/08) Heat-Strengthened Glass
- IG07 | (06/14) Thermal Breakage Prediction
- IG08 | (05/08) Use of Internal Grilles
- IG09 | (05/08) Glass Acoustical Information
- IG10 | (09/13) Fogging Potential in Insulating Glass Units
- IG11 | (05/08) Fading
- IG12 | (05/08) Glass Cleaning Recommendations
- IG13 | (05/08) Capillary Tubes & Breather Tubes
- IG14 | (08/12) Vinyl Siding Distortion
- IG15 | (05/08) Wood Treatment Compatibility with Insulating Glass Sealants
- IG16 | (09/13) Cardinal Preserve Film
- IG17 | (09/13) Use of Bumpers on Exposed Internal Grilles
- IG18 | (05/08) Distortion in Glass Products
- IG19 | (05/08) True Divided Lites (TDL) and Authentic Divided Lites vs. Superior Divided Lites (SDL)
- IG20 | (05/08) Insulating Glass Durability
- IG21 | (05/08) Certification and Testing for Insulating Glass ASTM E 2190
- IG22 | (05/08) Aluminum and SS XL Edge Spacers
- IG23 | (03/15) Triple-Pane Guidelines

Cardinal CG Company

- CG01 | (05/08) Edge Deletion of Sputtered Low-E Coatings
- CG02 | (05/08) Sealant Compatibility with Sputtered LoĒ™ Coatings
- CG03 | (05/08) IG Unit Frost Points, Internal Condensation and LoĒ™ & LoĒ²® Corrosion Potential
- CG04 | (10/14) Neat® Coated Glass
- CG05 | (09/13) Handling and Storage of Cardinal's LoĒ™ Coated Glass Products
- CG06 | (04/13) Cardinal LoĒ-i89™ Coating
- CG07 | (09/13) Haze in Glass Products

Cardinal FG Company

- FG01 | (09/13) Strain Pattern or Quench Pattern Characteristics
- FG02 | (05/08) GANA Bulletin "Heat-Treated Glass Surfaces are Different"
- FG03 | (05/08) Safety Glazing

Cardinal LG Company

- LG01 | (10/14) Miami-Dade County NOA's, and "Hurricane Impact" Certification
- LG02 | (10/14) Optical Distortion in Sea-Storm® Laminated Glass Fabricated with an Encapsulated PET Film
- LG03 | (10/14) Optical Distortion in Laminating Glass Fabricated with Heat Strengthened Glass Substrates

Cardinal Glass Industries

- Residential Glass Design Guide
- Architectural Glass Design Guide

Expert Witness and Testimony Cases

- Choate Construction vs. Novum Structures LLC and Safeco Insurance Company of America (April 7, 2014)
  In the State Court of Georgia in Atlanta GA
  Arbitration Testimony on the University of Georgia Athletic Association Building– Glass Fracture Analysis and Glass Fallout
  Retained by Hudson, Parrot Walker Representing Choate Construction – Plaintiff
  Deposition June 11th, 2015

- Anthony Hannah (Plaintiff) vs. Trulite Glass and Aluminum (Defendant) Civil Action No. 14cv-831-RPM
  In the United States District Court of Colorado.
  Injury Related to Glass Fallout from Wooden Crate
  Retained by Overturf, McGath & Hull P.C. Counsel for Defendant
  (February 19, 2015)

- CDC San Francisco LLC Webcor Builder Inc. Case No. CGC 15-SS46222 (Cal.Sup.Ct., San Francisco City) (2016) -Settled

- Hirschmann vs. Adco – Window Installation at Carrington/Crown Residential Project – Chicago – Settled

- Ronda Bryant vs. Belletech – Personal Injury Case – Settled

- Glass Damage, Breakage, Coated Glass, and Insulating Glass Failures 11 other cases settled or still active.

Expert Witness Fees - $400/Hour

Expert Report

Background

Since the UGAA project was completed, the University of Georgia has experienced approximately 9 fractures of the tempered glass on the project. I was initially involved in determining the cause of 2 of the fractures and determined that the cause of breakage was due to a Nickel Sulfide (NiS) inclusion in the installed Insulating, laminated glass product. I was contacted by Attorney Alex Bell of Hudson, Parrott, Walker, LLC in Atlanta to visit the project in March of 2020. Due to the Pandemic, with travel restrictions and lockdowns of cities and businesses, Mr. Bell, asked if it was possible for me to give an opinion of the cause of breakage, if a close-up high-resolution photo was taken of the breakage. I indicated that I believe it is possible to do this, knowing the background of previous breakages on this project. The information below is my report after inspecting the photographs taken at the job-site on June 2nd, 2020.

Report

Glass on the UGAA project is an insulating glass unit with the following construction.

Outdoors – 6mm Tempered coated

Indoors – 6mm Tempered laminated to 6mm tempered.

Since this is a reverse sloped glazing project, a protective film was applied to the outdoor tempered glass lite by the General Contractor, Choate, to reduce the potential for glass fallout of the opening if breakage were to occur.

I think it is prudent to talk about breakage potential of glass, as it will help others understand my rational and decision on the cause of the breakage on this project.

Annealed glass is glass that is not tempered. It can fracture from impact, bending stress, and thermal stress. For people that are experts in the forensic science of glass breakage, they have the ability to determine the specific cause of breakage and if the glass fracture origin is intact, also determine the cause and stress at fracture. For tempered glass, this glass has a compression layer completely around the glass that is 21% of the glass thickness and this compression stress is usually between 12,000 to 15,000 psi (pounds per square inch). For tempered glass to fracture from impact, bending stress or thermal stress, the stress must be higher than the compressive stress in the surface compression layer of the glass. Breakage of tempered glass from impact, bending stress, or thermal stress, does not happen very often as one needs a very high stress to fracture tempered glass.

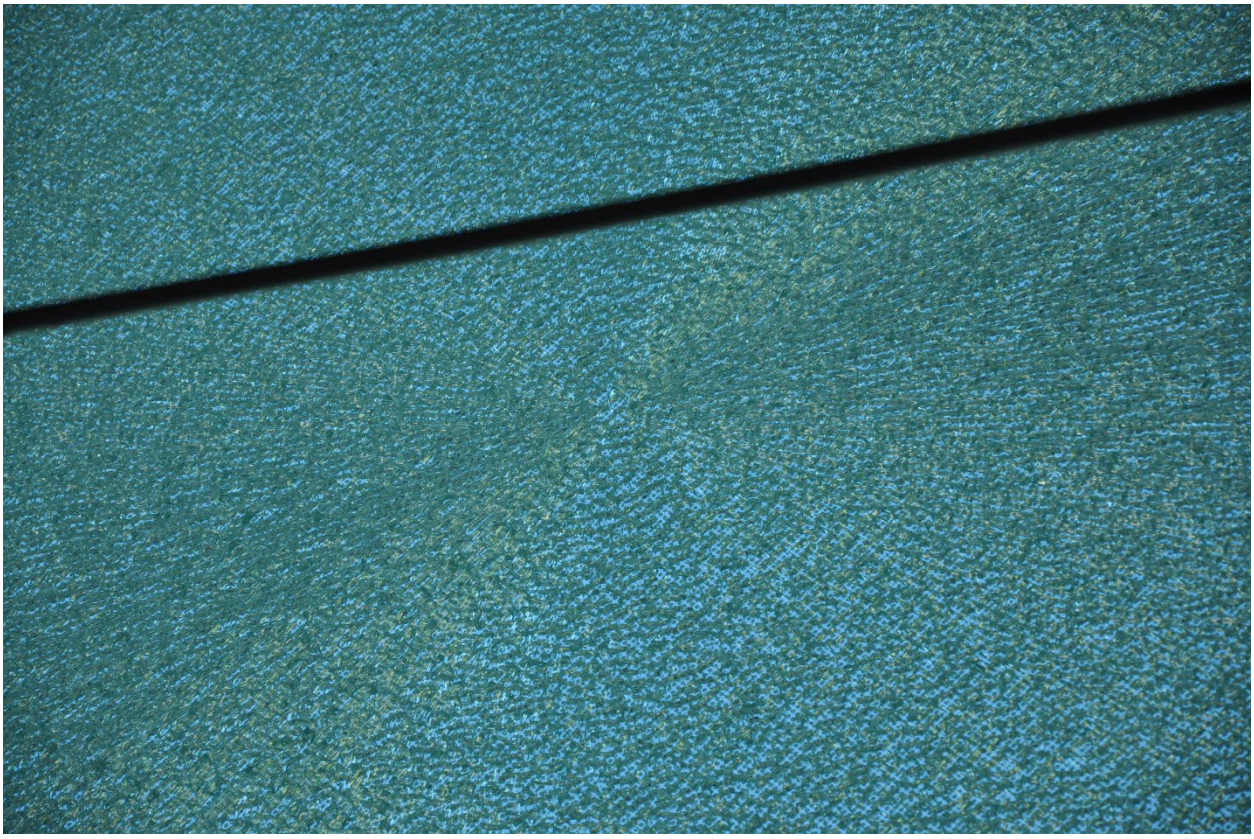
However, with that being said, tempered glass can fracture from a non-inspectable inclusion inside the central 58% of the glass thickness. This is noted as the tension layer in tempered glass. If a NiS stone is in annealed glass, breakage will not occur. However, in tempered glass, if the NiS stone is in the central tension section of the glass, it can in time expand and cause the glass to fracture. Many times, when the fracture of tempered glass occurs, a loud noise occurs that is the release of the tension layer energy in the glass. If the glass is not laminated or does not have a film on it, the fracture origin may not be found as the glass usually will fall out of the opening. However, if the glass is laminated or has a film on it, this keeps the fractured particles in place, and the fracture origin can be found. For a fracture in tempered glass caused by a NiS stone inclusion, the fracture origin can be determined as the fragments of the glass fracture emanated from the fracture origin. In the industry the fracture origins from a NiS inclusion are usually a 2 - 6 or 8 sided pieces of glass with each side being between ½ to 1 inch long. Taking these 2 sections apart will show a NiS stone close to the center of the thickness in the glass, which is in the tension zone of the glass. The photo of the fractured glass, the origin, and the glass fracture pattern emanating from the fracture origin is indicated in the photo.

I have been on many cases of tempered glass fractures from NiS stone inclusions. Although heat can cause the stones to increase in size, I have been involved in cases in malls where the sun never hits the glass and after 20 years the tempered glass has fractured from NiS stone inclusions. Heat can be an accelerant to make the stone increase in size and cause fractures, however, even without a high temperature on the glass, fracture of tempered glass can occur in time, but it takes longer for the stone to increase in size.

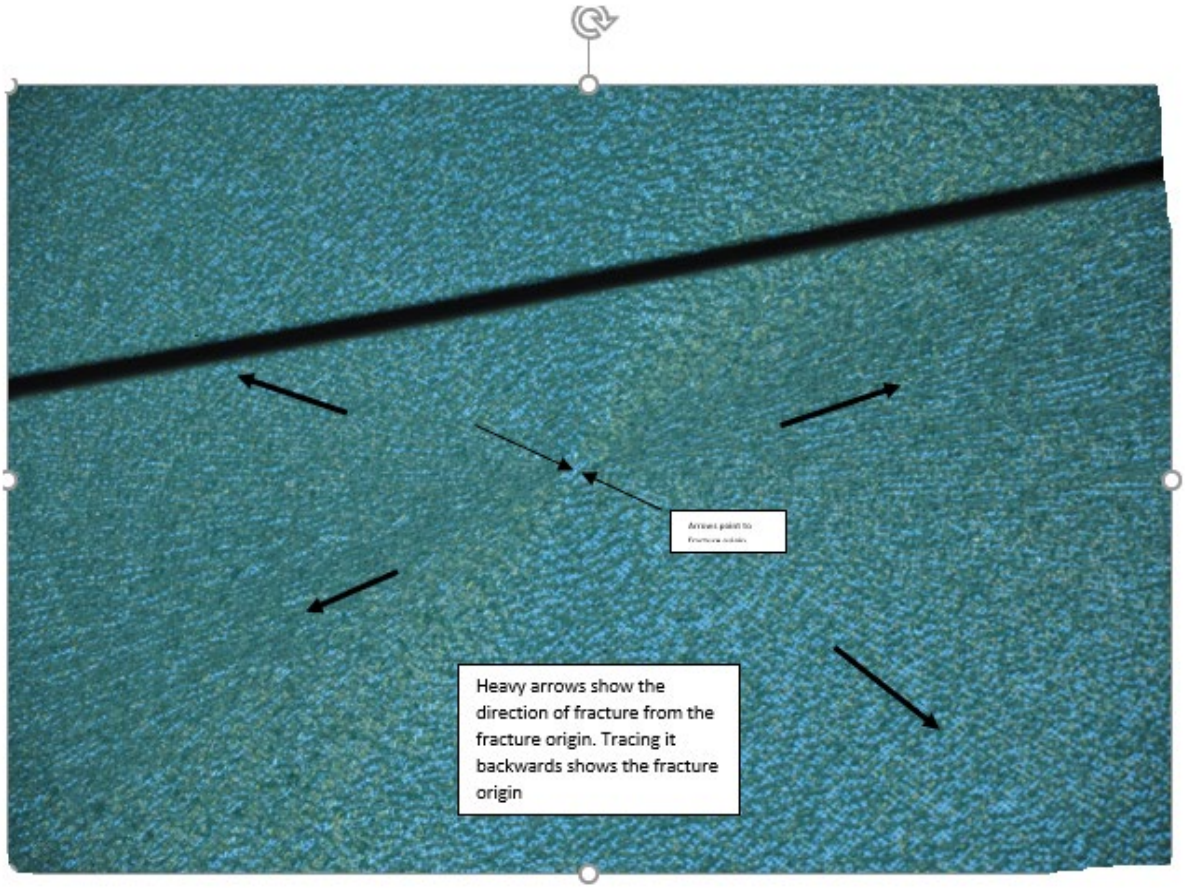
Cause of Fracture

It is my opinion that the glass fracture shown in the photograph below, my experience on the UGAA project, my 50 years of experience in the glass industry, that I am 80 to 90% certain that the glass fracture in the photo below on the UGAA project was caused by a NiS stone inclusion.

UGAA Project



Photograph of Tempered Glass Breakage at UGAA (Taken on 06-02-2020)



Photograph of Tempered Glass Breakage at UGAA (Taken on 06-02-2020) Showing Fracture Lines, and Fracture Origin.

R. G. Spindler

Robert G. Spindler
RGS Glass Consulting